NASA/TM—2000–209891, Vol. 12

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Jeffrey A. Newcomer, Editors

Volume 12
BOREAS AFM-6 Surface Meteorological Data

J. Wilczak

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

June 2000

The NASA STI Program Office ... in Profile

Since its founding, NASA has been dedicated to the advancement of aeronautics and space science. The NASA Scientific and Technical Information (STI) Program Office plays a key part in helping NASA maintain this important role.

The NASA STI Program Office is operated by Langley Research Center, the lead center for NASA's scientific and technical information. The NASA STI Program Office provides access to the NASA STI Database, the largest collection of aeronautical and space science STI in the world. The Program Office is also NASA's institutional mechanism for disseminating the results of its research and development activities. These results are published by NASA in the NASA STI Report Series, which includes the following report types:

- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA's counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.
- TECHNICAL MEMORANDUM. Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.
- CONFERENCE PUBLICATION. Collected papers from scientific and technical conferences, symposia, seminars, or other meetings sponsored or cosponsored by NASA.
- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and mission, often concerned with subjects having substantial public interest.
- TECHNICAL TRANSLATION. English-language translations of foreign scientific and technical material pertinent to NASA's mission.

Specialized services that complement the STI Program Office's diverse offerings include creating custom thesauri, building customized databases, organizing and publishing research results . . . even providing videos.

For more information about the NASA STI Program Office, see the following:

- Access the NASA STI Program Home Page at http://www.sti.nasa.gov/STI-homepage.html
- E-mail your question via the Internet to help@sti.nasa.gov
- Fax your question to the NASA Access Help Desk at (301) 621-0134
- Telephone the NASA Access Help Desk at (301) 621-0390
- Write to:
  NASA Access Help Desk
  NASA Center for AeroSpace Information
  7121 Standard Drive
  Hanover, MD 21076-1320

NASA/TM—2000–209891, Vol. 12

Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)

Forrest G. Hall and Jeffrey A. Newcomer, Editors

Volume 12
BOREAS AFM-6 Surface Meteorological Data

James Wilczak, National Oceanic and Atmospheric Administration
Environment Technology Laboratory

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

June 2000

Available from:

NASA Center for AeroSpace Information
7121 Standard Drive
Hanover, MD 21076-1320
Price Code: A17

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Price Code: A10

BOREAS AFM-6 Surface Meteorological Data

James Wilczak

Summary

The BOREAS AFM-6 team from the NOAA/ETL collected surface meteorological data from 21-May to 20-Sep-1994 near the SSA-OJP tower site. The data are in tabular ASCII files.

Table of Contents

1. Data Set Overview

1.1 Data Set Identification

BOREAS AFM-06 Surface Meteorological Data

1.2 Data Set Introduction

This data set includes surface meteorological data from a station set up by BOReal Ecosystem-Atmospheric Study (BOREAS) Airborne Fluxes and Meteorology (AFM)-06 team from the National Oceanic and Atmospheric Administration (NOAA)/Environment Technology Laboratory (ETL). Included in this data are date, time, wind direction, wind speed, relative humidity, and precipitation. The data were collected near the Southern Study Area (SSA)-Old Jack Pine (OJP) tower site from May to September in 1994.

1.3 Objective/Purpose

The BOREAS field work objectives were to measure surface meteorological conditions and continuous hourly profiles of wind velocity and temperature in the atmospheric boundary layer (ABL) and lower troposphere, to measure the depth of the daytime convective boundary layer, and to measure the occurrence of precipitation. The data were then to be used to document average boundary layer structure, and especially changes in boundary layer structure during the course of the boreal summer growing season.

1.4 Summary of Parameters

Included in this data are date, time, wind direction, wind speed, relative humidity, and precipitation.

1.5 Discussion

The surface meteorological station provided continuous measurement of wind speed and direction at a height of 2 m, and temperature and relative humidity at a height of 3 m. The data were recorded every 15 minutes.

1.6 Related Data Sets

BOREAS AFM-06 Mean Wind Profile Data
BOREAS AFM-06 Mean Temperature Profile Data
BOREAS AFM-06 Boundary Layer Height Data

2. Investigator(s)

2.1 Investigator(s) Name and Title

Robert Banta, Brooks Martner, James Wilczak NOAA Environmental Laboratory

2.2 Title of Investigation

Outer Boundary Layer Effects on Surface Fluxes of Momentum, etc. A Wind Profiler Climatology of Boundary Layer and Lower Tropospheric Structure Above the Boreal Forest

2.3 Contact Information

Contact 1:
James Wilczak
NOAA/ETL
325 Broadway
Boulder, CO 80303
(303) 497-6245
jwilczak@etl.noaa.gov

Contact 2:
Jeffrey A. Newcomer
Raytheon ITSS
Code 923
NASA GSFC
Greenbelt, MD 20771
(301) 286-7858
(301) 286-0239 (fax)
Jeffrey.Newcomer@gsfc.nasa.gov

3. Theory of Measurements

None given.

4. Equipment

4.1 Sensor/Instrument Description
None given.

4.1.1 Collection Environment
The surface meteorological station was used during various ambient weather conditions that occurred at the BOREAS SSA-OJP site.

4.1.2 Source/Platform
Ground-based.

4.1.3 Source/Platform Mission Objectives
The ground supported the measuring equipment.

4.1.4 Key Variables
Included in this data are date, time, wind direction, wind speed, relative humidity, and precipitation.

4.1.5 Principles of Operation
None given.

4.1.6 Sensor/Instrument Measurement Geometry
None given.

4.1.7 Manufacturer of Sensor/Instrument
None given.

4.2 Calibration

4.2.1 Specifications
None given.

4.2.1.1 Tolerance
None given.

4.2.2 Frequency of Calibration
None given.

4.2.3 Other Calibration Information
None given.

5. Data Acquisition Methods

None given

6. Observations

6.1 Data Notes

The surface meteorological station operated unattended for most of the 4-month observation period.

6.2 Field Notes

The surface meteorological measurements were taken near the SSA-OJP tower flux site. The radar site was in a clearing in the jack pine forest, with fetches (clear distances) of 200 m to the north, 500 m to the south, 150 m to the east, and 1 km to the west. Ground cover within the clearing consisted of grass, brush, and young jack pine trees, approximately 1-2 m tall.

7. Data Description

7.1 Spatial Characteristics

7.1.1 Spatial Coverage

The North American Datum of 1983 (NAD83) coordinates of the site are:

```
Lat.    =  53.91 °N
Long.   =  104.40 °W
Alt.    =  511 m above sea level
```

This location is 1.0 km south, and 1.6 km east of the SSA-OJP flux tower.

7.1.2 Spatial Coverage Map

Not available.

7.1.3 Spatial Resolution

These are point source data at the given location.

7.1.4 Projection

Not applicable.

7.1.5 Grid Description

Not applicable.

7.2 Temporal Characteristics

7.2.1 Temporal Coverage

Measurements were made from 21-May-1994 through 20-Sep-1994.

7.2.2 Temporal Coverage Map

Not available.

7.2.3 Temporal Resolution

Measurements were made every 15 minutes during the period.

7.3 Data Characteristics

7.3.1 Parameter/Variable

The parameters contained in the data files on the CD-ROM are:

Column Name
SITE_NAME
SUB_SITE
DATE_OBS
TIME_OBS
AIR_TEMP
WIND_DIR
WIND_SPEED
REL_HUM
PRECIPITATION
VOLTAGE
CRTFCN_CODE
REVISION_DATE

7.3.2 Variable Description/Definition

The descriptions of the parameters contained in the data files on the CD-ROM are:

Column Name	Description
SITE_NAME	The identifier assigned to the site by BOREAS, in in the format SSS-TTT-CCCCC, where SSS identifies the portion of the study area: NSA, SSA, REG, TRN, and TTT identifies the cover type for the site, 999 if unknown, and CCCCC is the identifier for site, exactly what it means will vary with site type.
SUB_SITE	The identifier assigned to the sub-site by BOREAS in the format GGGGG-IIIII, where GGGGG is the group associated with the sub-site instrument, e.g. HYD06 or STAFF, and IIIII is the identifier for sub-site, often this will refer to an instrument.
DATE_OBS	The date on which the data were collected.
TIME_OBS	The Greenwich Mean Time (GMT) when the data were collected.
AIR_TEMP	The air temperature.
WIND_DIR	The direction from which the wind was traveling, increasing in a clockwise direction from north.
WIND_SPEED	The wind speed.
REL_HUM	The calculated relative humidity.
PRECIPITATION	The amount of precipitation measured by the rain gauge for the 15 minute period preceding the given time.
VOLTAGE	The measured battery voltage.
CRTFCN_CODE	The BOREAS certification level of the data. Examples CPI (Checked by PI), CGR (Certified by Group), PRE (Preliminary), and CPI-??? (CPI but questionable).
REVISION_DATE	The most recent date when the information in the referenced data base table record was revised.

7.3.3 Unit of Measurement

The measurement units for the parameters contained in the data files on the CD-ROM are:

Column Name	Units
SITE_NAME	[none]
SUB_SITE	[none]
DATE_OBS	[DD-MON-YY]
TIME_OBS	[HHMM GMT]
AIR_TEMP	[degrees Celsius]
WIND_DIR	[degrees]
WIND_SPEED	[meters][second^-1]
REL_HUM	[percent]
PRECIPITATION	[millimeters]
VOLTAGE	[volts]
CRTFCN_CODE	[none]
REVISION_DATE	[DD-MON-YY]

7.3.4 Data Source

The sources of the parameter values contained in the data files on the CD-ROM are:

Column Name	Data Source
SITE_NAME	[Assigned by BORIS]
SUB_SITE	[Assigned by BORIS]
DATE_OBS	[Supplied by NOAA/ETL]
TIME_OBS	[Supplied by NOAA/ETL]
AIR_TEMP	[Supplied by NOAA/ETL]
WIND_DIR	[Supplied by NOAA/ETL]
WIND_SPEED	[Supplied by NOAA/ETL]
REL_HUM	[Supplied by NOAA/ETL]
PRECIPITATION	[Supplied by NOAA/ETL]
VOLTAGE	[Supplied by NOAA/ETL]
CRTFCN_CODE	[Assigned by BORIS]
REVISION_DATE	[Assigned by BORIS]

7.3.5 Data Range

The following table gives information about the parameter values found in the data files on the CD-ROM.

Column Name	Minimum Data Value	Maximum Data Value	Missng Data Value	Unrel Data Value	Below Detect Limit	Data Not Cllctd
SITE_NAME	SSA-OJP-RDR01	SSA-OJP-RDR01	None	None	None	None
SUB_SITE	AFM06-RDR01	AFM06-RDR01	None	None	None	None
DATE_OBS	20-MAY-94	21-SEP-94	None	None	None	None
TIME_OBS	0	2345	None	None	None	None
AIR_TEMP	-1.61	31.28	None	None	None	None
WIND_DIR	0	360	None	None	None	None
WIND_SPEED	0	7.2	None	None	None	None
REL_HUM	11.56	102.96	None	None	None	None
PRECIPITATION	0	23.114	None	None	None	None
VOLTAGE	12.42	14.38	None	None	None	None

```
CRTFCN_CODE          CPI            CPI            None    None   None    None
REVISION_DATE        22-AUG-96      22-AUG-96      None    None   None    None
-------------------------------------------------------------------------------
Minimum Data Value -- The minimum value found in the column.
Maximum Data Value -- The maximum value found in the column.
Missng Data Value  -- The value that indicates missing data. This is used to
                      indicate that an attempt was made to determine the
                      parameter value, but the attempt was unsuccessful.
Unrel Data Value   -- The value that indicates unreliable data.  This is used
                      to indicate an attempt was made to determine the
                      parameter value, but the value was deemed to be
                      unreliable by the analysis personnel.
Below Detect Limit -- The value that indicates parameter values below the
                      instruments detection limits.  This is used to
                      indicate that an attempt was made to determine the
                      parameter value, but the analysis personnel determined
                      that the parameter value was below the detection
                      limit of the instrumentation.
Data Not Cllctd    -- This value indicates that no attempt was made to
                      determine the parameter value.  This usually
                      indicates that BORIS combined several similar but
                      not identical data sets into the same data base table
                      but this particular science team did not
                      measure that parameter.

Blank -- Indicates that blank spaces are used to denote that type of value.
N/A   -- Indicates that the value is not applicable to the respective column.
None  -- Indicates that no values of that sort were found in the column.
-------------------------------------------------------------------------------
```

7.4 Sample Data Record

The following are wrapped versions of data records from a sample data file on the CD-ROM.

```
SITE_NAME,SUB_SITE,DATE_OBS,TIME_OBS,AIR_TEMP,WIND_DIR,WIND_SPEED,REL_HUM,
PRECIPITATION,VOLTAGE,CRTFCN_CODE,REVISION_DATE
'SSA-OJP-RDR01','AFM06-RDR01',26-JUL-94,0,24.68,64,2.4,15.926,0.0,13.64,'CPI',
22-AUG-96
'SSA-OJP-RDR01','AFM06-RDR01',26-JUL-94,15,24.52,58,1.9,16.066,0.0,13.65,'CPI',
22-AUG-96
'SSA-OJP-RDR01','AFM06-RDR01',26-JUL-94,30,24.51,34,2.0,16.479,0.0,13.65,'CPI',
22-AUG-96
'SSA-OJP-RDR01','AFM06-RDR01',26-JUL-94,45,24.27,49,1.9,16.62,0.0,13.66,'CPI',
22-AUG-96
```

8. Data Organization

8.1 Data Granularity

The smallest unit of data tracked by the BOREAS Information System (BORIS) was the data collected at a given site on a given date.

8.2 Data Format(s)

The Compact Disk-Read-Only Memory (CD-ROM) files contain American Standard Code for Information Interchange (ASCII) numerical and character fields of varying length separated by commas. The character fields are enclosed with single apostrophe marks. There are no spaces between the fields.

Each data file on the CD-ROM has four header lines of Hyper-Text Markup Language (HTML) code at the top. When viewed with a Web browser, this code displays header information (data set title, location, date, acknowledgments, etc.) and a series of HTML links to associated data files and related data sets. Line 5 of each data file is a list of the column names, and line 6 and following lines contain the actual data.

9. Data Manipulations

9.1 Formulae

9.1.1 Derivation Techniques and Algorithms

None given.

9.2 Data Processing Sequence

9.2.1 Processing Steps

None given.

9.2.2 Processing Changes

None given.

9.3 Calculations

9.3.1 Special Corrections/Adjustments

None given.

9.3.2 Calculated Variables

None given.

9.4 Graphs and Plots

None given.

10. Errors

10.1 Sources of Error

None given.

10.2 Quality Assessment

10.2.1 Data Validation by Source
None given.

10.2.2 Confidence Level/Accuracy Judgment
None given.

10.2.3 Measurement Error for Parameters
None given.

10.2.4 Additional Quality Assessments
None given.

10.2.5 Data Verification by Data Center
BORIS personnel verified that the delivered data agreed with the information provided by the AFM-06 team.

11. Notes

11.1 Limitations of the Data
None given.

11.2 Known Problems with the Data
None given.

11.3 Usage Guidance
None given.

11.4 Other Relevant Information
None given.

12. Application of the Data Set

These data could be used in conjunction with other surface meteorological data to get an areal perspective of surface meteorological conditions over the SSA.

13. Future Modifications and Plans

None given.

14. Software

14.1 Software Description
None given.

14.2 Software Access
None given.

15. Data Access

The surface meteorological data are available from the Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

15.1 Contact Information

For BOREAS data and documentation please contact:

ORNL DAAC User Services
Oak Ridge National Laboratory
P.O. Box 2008 MS-6407
Oak Ridge, TN 37831-6407
Phone: (423) 241-3952
Fax: (423) 574-4665
E-mail: ornldaac@ornl.gov or ornl@eos.nasa.gov

15.2 Data Center Identification

Earth Observing System Data and Information System (EOSDIS) Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemical Dynamics http://www-eosdis.ornl.gov/ [Internet Link].

15.3 Procedures for Obtaining Data

Users may obtain data directly through the ORNL DAAC online search and order system [http://www-eosdis.ornl.gov/] and the anonymous FTP site [ftp://www-eosdis.ornl.gov/data/] or by contacting User Services by electronic mail, telephone, fax, letter, or personal visit using the contact information in Section 15.1.

15.4 Data Center Status/Plans

The ORNL DAAC is the primary source for BOREAS field measurement, image, GIS, and hardcopy data products. The BOREAS CD-ROM and data referenced or listed in inventories on the CD-ROM are available from the ORNL DAAC.

16. Output Products and Availability

16.1 Tape Products

None.

16.2 Film Products

None.

16.3 Other Products

These data are available on the BOREAS CD-ROM series.

17. References

17.1 Platform/Sensor/Instrument/Data Processing Documentation

None given.

17.2 Journal Articles and Study Reports

Newcomer, J., D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers, eds. 2000. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM.

Sellers, P. and F. Hall. 1994. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1994-3.0, NASA BOREAS Report (EXPLAN 94).

Sellers, P. and F. Hall. 1996. Boreal Ecosystem-Atmosphere Study: Experiment Plan. Version 1996-2.0, NASA BOREAS Report (EXPLAN 96).

Sellers, P., F. Hall, and K.F. Huemmrich. 1996. Boreal Ecosystem-Atmosphere Study: 1994 Operations. NASA BOREAS Report (OPS DOC 94).

Sellers, P., F. Hall, and K.F. Huemmrich. 1997. Boreal Ecosystem-Atmosphere Study: 1996 Operations. NASA BOREAS Report (OPS DOC 96).

Sellers, P., F. Hall, H. Margolis, B. Kelly, D. Baldocchi, G. den Hartog, J. Cihlar, M.G. Ryan, B. Goodison, P. Crill, K.J. Ranson, D. Lettenmaier, and D.E. Wickland. 1995. The boreal ecosystem-atmosphere study (BOREAS): an overview and early results from the 1994 field year. Bulletin of the American Meteorological Society. 76(9):1549-1577.

Sellers, P.J., F.G. Hall, R.D. Kelly, A. Black, D. Baldocchi, J. Berry, M. Ryan, K.J. Ranson, P.M. Crill, D.P. Lettenmaier, H. Margolis, J. Cihlar, J. Newcomer, D. Fitzjarrald, P.G. Jarvis, S.T. Gower, D. Halliwell, D. Williams, B. Goodison, D.E. Wickland, and F.E. Guertin. 1997. BOREAS in 1997: Experiment Overview, Scientific Results and Future Directions. Journal of Geophysical Research 102(D24): 28,731-28,770.

17.3 Archive/DBMS Usage Documentation

None.

18. Glossary of Terms

None.

19. List of Acronyms

```
ABL     - Atmospheric Boundary Layer
AFM     - Airborne Fluxes and Meteorology
ASCII   - American Standard Code for Information Interchange
BOREAS  - BOReal Ecosystem-Atmosphere Study
BORIS   - BOREAS Information System
CD-ROM  - Compact Disk - Read-Only Memory
DAAC    - Distributed Active Archive Center
```

```
EOS      - Earth Observing System
EOSDIS   - EOS Data and Information System
ETL      - Environment Technology Laboratory
GIS      - Geographic Information System
GMT      - Greenwich Mean Time
GSFC     - Goddard Space Flight Center
HTML     - HyperText Markup Language
NAD83    - North American Datum of 1983
NASA     - National Aeronautics and Space Administration
NOAA     - National Oceanic and Atmospheric Administration
NSA      - Northern Study Area
OJP      - Old Jack Pine
ORNL     - Oak Ridge National Laboratory
PANP     - Prince Albert National Park
RASS     - Radio Acoustic Sounding System
SSA      - Southern Study Area
URL      - Uniform Resource Locator
```

20. Document Information

20.1 Document Revision Dates

Written: 07-Jun-1996
Last Updated: 25-Aug-1999

20.2 Document Review Date

BORIS Review: 29-Jan-1999
Science Review:

20.3 Document ID

20.4 Citation

When using these data, please include the following acknowledgment as well as citations of relevant papers in Section 17.2:

Wind profiler (and/or surface meteorological) data provided by Dr. James Wilczak, NOAA Environmental Technology Laboratory

If using data from the BOREAS CD-ROM series, also reference the data as:

Banta, R., B. Martner, and J. Wilczak, "Outer Boundary Layer Effects on Surface Fluxes of Momentum, etc. A Wind Profiler Climatology of Boundary Layer and Lower Tropospheric Structure Above the Boreal Forest." In Collected Data of The Boreal Ecosystem-Atmosphere Study. Eds. J. Newcomer, D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers. CD-ROM. NASA, 2000.

Also, cite the BOREAS CD-ROM set as:

Newcomer, J., D. Landis, S. Conrad, S. Curd, K. Huemmrich, D. Knapp, A. Morrell, J. Nickeson, A. Papagno, D. Rinker, R. Strub, T. Twine, F. Hall, and P. Sellers, eds. Collected Data of The Boreal Ecosystem-Atmosphere Study. NASA. CD-ROM. NASA, 2000.

20.5 Document Curator

20.6 Document URL

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 2000	Technical Memorandum

4. TITLE AND SUBTITLE
Technical Report Series on the Boreal Ecosystem-Atmosphere Study (BOREAS)
BOREAS AFM-6 Surface Meteorological Data

5. FUNDING NUMBERS
923
RTOP: 923-462-33-01

6. AUTHOR(S)
James Wilczak
Forrest G. Hall and Jeffrey A. Newcomer, Editors

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS (ES)
Goddard Space Flight Center
Greenbelt, Maryland 20771

8. PEFORMING ORGANIZATION REPORT NUMBER
2000-03136-0

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS (ES)
National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
TM—2000–209891
Vol. 12

11. SUPPLEMENTARY NOTES
J. Wilczak: National Oceanic and Atmospheric Administration Environment Technology Laboratory;
J.A. Newcomer: Raytheon ITSS

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Unclassified–Unlimited
Subject Category: 43
Report available from the NASA Center for AeroSpace Information,
7121 Standard Drive, Hanover, MD 21076-1320. (301) 621-0390.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The BOREAS AFM-6 team from the NOAA/ETL collected surface meteorological data from 21-May to 20-Sep-1994 near the SSA-OJP tower site. The data are in tabular ASCII files.

14. SUBJECT TERMS
BOREAS, airborne flux and meteorology, surface meteorological data.

15. NUMBER OF PAGES
12

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL